this produce CE to I so that $CE \cdot CI = CA \cdot CB$ and construct an angle at I equal to $90°+\alpha$. Then F is the point where the side of this angle meets the segment containing $\angle\alpha$; for E, H, F, I are on a circle and $CE \cdot CI = CH \cdot CF$.

Draw FE and let it meet the perpendicular to FC at C in point D. Pass a circle through D, C, F and where this circle meets EH extended will be points A and B. The triangle ABC is then the required triangle.

Also solved by A. H. Holmes, David F. Kelley, Elmer Schuyler, and A. M. Harding.

A solution of 416 was received from S. W. Reaves too late for notice in the November, 1913, issue.

No solution has been received for 421.

CALCULUS.

A solution of 334 has been received to which the author neglected to sign his name. Two solutions of 327, which was reprinted in the February, 1913, issue, p. 68, have been received. Also solutions are in hand for 336, 339, 341, and 343. All of these will appear in the next issue. Meanwhile we hope to hear from 337, 338, 340, 342, and 344, which include all published up to November, 1913.

MECHANICS.

No solutions have been received for the following problems in mechanics: 246 published in October, 1911; 266 in December, 1911; 268 in January and 269 in April, 1912, and none of those published in 1913, namely 271–283.

Solutions of these problems are desired.

Please remember that problems 276–279 are incorrectly numbered 271–274. See page 258 of the October, 1913, issue.

NUMBER THEORY AND DIOPHANTINE ANALYSIS.

190. Proposed by H. C. FEEMSTER.

Show that, if n is a prime number and r an integer less than n, then

$$(r-1)!\,(n-r)! + (-1)^{r-1} = M \cdot n,$$

where M is an integer.

Solution by Thomas E. Mason, Indiana University.

From the Wilson theorem we have

$$(n-1)! + 1 \equiv 0 \quad \mod n. \tag{1}$$

We have also,

$$(n-1)(n-2)\cdots(n-r+1) \equiv (-1)(-2)\cdots(-r+1) \quad \mod n.$$
$$\equiv (-1)^{r-1}(r-1)! \quad \mod n. \tag{2}$$

Making substitution from (2) in (1) we get

$$(-1)^{r-1}(r-1)!(n-r)! + 1 \equiv 0 \quad \mod n,$$

or

$$(r-1)!(n-r)! + (-1)^{r-1} \equiv 0 \quad \mod n,$$

which proves the theorem.

Also solved by B. F. YANNEY, L. C. MATHEWSON, and the PROPOSER.

Note. No solutions have been received for problems proposed in 1913 under this heading, except for 188 and 190. Solutions for the remaining ones are desired. Please remember that 191 to 196 are incorrectly numbered 187–192. See page 258 of the October, 1913, issue.

MISCELLANEOUS QUESTIONS.

EDITED BY R. D. CARMICHAEL.

The new department of "Miscellaneous Questions" has met with a pleasing reception among our readers; and we desire to express our appreciation of the interest which has already been manifested through the contributions of questions and replies. We hope to have the coöperation of a considerable number of persons in realizing the double purpose announced in the issue of November, 1913. One of our correspondents, who is a physicist, has written concerning one of these purposes; and we desire to call attention to his remarks in order that we may invite our readers to assist us in realizing the advantages which are mentioned:

"I believe that your department of miscellaneous questions could render valuable service in bringing together the mathematicians and the physicists. Generally the physicist does not know his mathematics sufficiently well to enable him to handle original problems, while the mathematician cannot keep in touch with the developments in physics; but it ought to be possible to work out a plan so that the combined skill of the mathematician and the physicist could be utilized in the solution of the many physical problems. It strikes me that your department of miscellaneous questions could be developed so as to cover this field, and I believe that it would be very useful."

In this issue we have the first replies to our questions. This is the time to say that a question is not disposed of because we have published some answers to it. We wish to have it understood clearly that, although it is desirable to have early replies to our questions, it is yet never too late to send in other replies. In fact, we believe that it will often happen that one set of answers to a given question will provoke others; and that the same question may often be discussed through several issues. Question 2 is one which is probably of this kind.

Again, we shall often print partial answers to a given question in order to call forth a further or more complete answer. This we are doing in the present issue in the case of question 1.

QUESTION.

5. In what ways may mathematics contribute most to the culture of the individual? What is being done and what may be done to advantage in the matter of developing courses in culture mathematics?

REPLIES.

1. In connection with the investigation of a problem in physics Mr. Louis Cohen, Washington, D. C., requires to have expressed in the form of a Fourier's series

$$y = \Sigma A_n \cos nt + \Sigma \beta_n \sin nt \tag{1}$$